

# Teaching for transfer

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**Abstract.** Students, after they leave our care, are called to solve the diverse problems offered by the world, so we should teach to increase *transfer*: the ability to apply fundamental principles to new problems and contexts. This ability is rare.

The following pages are from a workshop for faculty on designing courses that promote transfer. I discuss two design principles: to *name* the transferable ideas and to illustrate them with examples from *diverse subjects*. The discussion uses dimensional reasoning as the example of a valuable transferable idea, illustrating it with three diverse examples.

# One theme to bind them all

*[I don't give away the name of the technique yet, hence the coy section title, so that participants can discover it by discussion.]*

## Pyramid volume

*[I ask the participants to discuss, in small groups, the flaws in the proposed volumes. Then we name the technique – dimensional analysis – for use in the next examples.]*

Here is a pyramid with a square base. It has height  $h$  and the side of the base is  $b$ . Comment on these proposed formulas for the volume:

- a.  $\frac{1}{3}bh$
- b.  $h^3 + b^2 + b$
- c.  $b^4 + h^3$
- d.  $b^4/h$

## GDP

*[To teach for transfer, people must practice transfer to other domains. So I ask the audience to find the worst flaw in the following argument, which comes from a domain far from physics or mathematics.]*

In many articles criticizing globalization (the kinder, gentler name for imperialism), you can read an argument like this one [from ‘Impunity for Multinationals’, [www.globalpolicy.org/socecon/tncs/2002/0911impunity.htm](http://www.globalpolicy.org/socecon/tncs/2002/0911impunity.htm), 11 Sept 2002]:

*In Nigeria, a relatively economically strong country, the GDP is \$99 billion. The net worth of Exxon is \$119 billion. ‘When multinationals have a net worth higher than the GDP of the country in which they operate, what kind of power relationship are we talking about?’ asks Laura Morosini.*

Find the most egregious fault in this argument.

## Tidal waves

*[And a hard example of dimensional analysis, to show that the wave speed is  $v = \sqrt{gh}$ .]*

The speed of water waves in shallow water depends on the depth and on gravity, which provides the force that drives the waves. Find a formula that connects the speed  $v$  to the gravitational acceleration  $g$  and to the depth  $h$ .

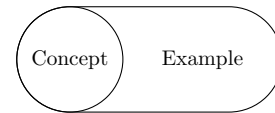
Tidal waves on the ocean are an example of shallow-water waves (!). How fast do they travel?

# Why use diverse examples

Here is a line of reasoning showing why diverse examples promote transfer.

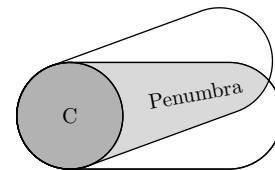
## One example

A bare concept is difficult to grasp without examples. Examples help learners to understand the concept and, if chosen well, to separate the transferable concept from the illustrations. Suppose then that you explain a concept and illustrate it with an example. The concept and example merge in the learner's mind, leaving him or her uncertain about the boundaries of the concept.



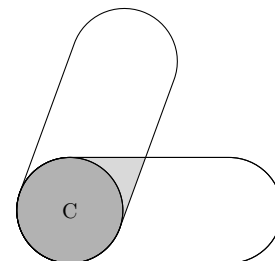
## Two examples

One remedy is to offer a second example. To the extent that the second example is similar to the first, the first concept plus example overlaps the second concept plus example. The overlap includes a penumbra around the concept. The penumbra is smaller than when only one example is offered, and the two examples delimit the boundaries of the concept more clearly than when only one example is offered. Progress!



## Diverse examples

You can help the learner even more by taking the second (or third) example from a distant field: wherefore **curriculum integration**. The penumbra shrinks and the concept stands out.



***‘Only connect! That was the whole of her sermon...Live in fragments no longer.’*** E. M. Forster, *Howard’s End*.